

What is claimed is:

1. A receptor cassette encoding a chimeric receptor polypeptide comprising:
 - a) a DNA binding (C) domain;
 - b) a hinge (D) domain of an ecdysone receptor (EcR) of an insect selected from the group consisting of *Manduca sexta*, *Agrotis ipsilon*, *Spodoptera frugiperda*, *Chironomus tentans*, and *Locusta migratoria*;
 - c) a ligand binding (E) domain that is heterologous with respect to said hinge (D) domain; and
 - d) an activation domain.
2. A receptor cassette according to claim 1, wherein:
 - a) said DNA binding (C) domain is a *Manduca sexta* EcR DNA binding (C) domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is a *Drosophila melanogaster* EcR ligand binding (E) domain;
 - b) said DNA binding (C) domain is a *Manduca sexta* EcR DNA binding (C) domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is an *Agrotis ipsilon* EcR ligand binding (E) domain;
 - c) said DNA binding (C) domain is a GAL4 DNA binding domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is an *Agrotis ipsilon* EcR ligand binding (E) domain;
 - d) said DNA binding (C) domain is a *Manduca sexta* EcR DNA binding (C) domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is an *Ostrinia nubilalis* EcR ligand binding (E) domain;
 - e) said DNA binding (C) domain is a GAL4 DNA binding domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is an *Ostrinia nubilalis* EcR ligand binding (E) domain;
 - f) said DNA binding (C) domain is a *Manduca sexta* EcR DNA binding (C) domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is a *Spodoptera frugiperda* EcR ligand binding (E) domain;

- g) said DNA binding (C) domain is a GAL4 DNA binding domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is a *Spodoptera frugiperda* EcR ligand binding (E) domain;
- h) said DNA binding (C) domain is a *Locusta migratoria* EcR DNA binding (C) domain, said hinge (D) domain is a *Locusta migratoria* EcR hinge (D) domain, and said ligand binding (E) domain is a *Manduca sexta* EcR ligand binding (E) domain;
- i) said DNA binding (C) domain is a *Manduca sexta* EcR DNA binding (C) domain, said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and said ligand binding (E) domain is a *Locusta migratoria* EcR ligand binding (E) domain;
- j) said DNA binding (C) domain is a *Chironomus tentans* EcR DNA binding (C) domain, said hinge (D) domain is a *Chironomus tentans* EcR hinge (D) domain, and said ligand binding (E) domain is a *Manduca sexta* EcR ligand binding (E) domain; or
- k) said DNA binding (C) domain is a *Manduca sexta* EcR DNA binding (C) domain, said hinge (D) domain is a *Chironomus tentans* EcR hinge (D) domain, and said ligand binding (E) domain is a *Chironomus tentans* EcR ligand binding (E) domain.
3. A receptor cassette according to claim 2, wherein said activation domain is a VP16 activation domain.
4. A receptor cassette according to claim 1, wherein said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, and wherein said ligand binding (E) domain is an *Ostrinia nubilalis* EcR ligand binding (E) domain.
5. A receptor cassette according to claim 4, wherein said DNA binding (C) domain is a GAL4 DNA binding domain.
6. A receptor cassette according to claim 5, wherein the C, D, and E domains of said chimeric receptor polypeptide comprise an amino acid sequence at least 90% identical to amino acids 1-508 of SEQ ID NO:121.

1. *Not a student of the University of California, Los Angeles.*

Chironomus tentans, and *Locusta migratoria*, wherein said ligand binding (E) domain is heterologous with respect to said hinge (D) domain; and

d) an activation domain.

d) an activation domain.

16. A receptor cassette according to claim 15, wherein:

a) said DNA binding (C) domain is an *Ostrinia nubilalis* EcR DNA binding (C) domain, said hinge (D) domain is an *Ostrinia nubilalis* EcR hinge (D) domain, and said ligand binding (E) domain is an *Agrotis ipsilon* EcR ligand binding (E) domain;

b) said DNA binding (C) domain is an *Ostrinia nubilalis* EcR DNA binding (C) domain, said hinge (D) domain is an *Ostrinia nubilalis* EcR hinge (D) domain, and said ligand binding (E) domain is a *Manduca sexta* EcR ligand binding (E) domain;

c) said DNA binding (C) domain is a GAL4 DNA binding domain, said hinge (D) domain is an *Ostrinia nubilalis* EcR hinge (D) domain, and said ligand binding (E) domain is a *Manduca sexta* EcR ligand binding (E) domain;

d) said DNA binding (C) domain is a *Drosophila melanogaster* EcR DNA binding (C) domain, said hinge (D) domain is a *Drosophila melanogaster* EcR hinge (D) domain, and said ligand binding (E) domain is a *Manduca sexta* EcR ligand binding (E) domain; or

e) said DNA binding (C) domain is a *Drosophila melanogaster* EcR DNA binding (C) domain, said hinge (D) domain is a *Drosophila melanogaster* EcR hinge (D) domain, and said ligand binding (E) domain is an *Agrotis ipsilon* EcR ligand binding (E) domain.

17. A receptor cassette according to claim 16, wherein said activation domain is a VP16 activation domain.

18. A receptor cassette encoding a chimeric receptor polypeptide comprising:

a) a GAL4 DNA binding domain or a DNA binding (C) domain of an ecdysone receptor (EcR) of an insect selected from the group consisting of *Ostrinia nubilalis*, *Locusta migratoria*, *Chironomus tentans*, *Manduca sexta*, and *Drosophila melanogaster*;

- b) a hinge (D) domain of an ecdysone receptor of an insect selected from the group consisting of *Ostrinia nubilalis*, *Locusta migratoria*, *Chironomus tentans*, *Manduca sexta*, and *Drosophila melanogaster*;
- c) a ligand binding (E) domain of an ecdysone receptor of an insect selected from the group consisting of *Ostrinia nubilalis*, *Locusta migratoria*, *Chironomus tentans*, *Manduca sexta*, and *Drosophila melanogaster*; and
- d) a heterologous activation domain;

wherein said chimeric receptor polypeptide does not include an ecdysone receptor A/B N-terminal domain.

19. A receptor cassette according to claim 18, wherein said chimeric receptor polypeptide consists essentially of:

- a) a GAL4 DNA binding domain or a DNA binding (C) domain of an ecdysone receptor (EcR) of an insect selected from the group consisting of *Ostrinia nubilalis*, *Locusta migratoria*, *Chironomus tentans*, *Manduca sexta*, and *Drosophila melanogaster*;
- b) a hinge (D) domain of an ecdysone receptor of an insect selected from the group consisting of *Ostrinia nubilalis*, *Locusta migratoria*, *Chironomus tentans*, *Manduca sexta*, and *Drosophila melanogaster*;
- c) a ligand binding (E) domain of an ecdysone receptor of an insect selected from the group consisting of *Ostrinia nubilalis*, *Locusta migratoria*, *Chironomus tentans*, *Manduca sexta*, and *Drosophila melanogaster*; and
- d) a heterologous activation domain that is not an ecdysone receptor A/B N-terminal domain.

20. A receptor cassette according to claim 18, wherein:

- a) said DNA binding (C) domain is an *Ostrinia nubilalis* EcR DNA binding (C) domain, said hinge (D) domain is an *Ostrinia nubilalis* EcR hinge (D) domain, and said ligand binding (E) domain is an *Ostrinia nubilalis* EcR ligand binding (E) domain;

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22. A receptor cassette according to claim 18, wherein said DNA binding (C) domain is a GAL4 DNA binding domain, wherein said hinge (D) domain is a *Manduca sexta* EcR hinge (D) domain, wherein said ligand binding (E) domain is a *Manduca sexta* EcR ligand binding (E) domain, and wherein said activation domain is a VP16 activation domain.

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31. A receptor cassette according to claim 30, wherein said chimeric receptor polypeptide consists essentially of:

- a) at least one DNA binding (C) domain;
- b) a hinge (D) domain of an insect ecdysone receptor;
- c) a ligand binding (E) domain of an insect ecdysone receptor, wherein said ligand binding (E) domain is heterologous with respect to said hinge (D) domain; and
- d) a heterologous activation domain that is not an ecdysone receptor A/B N-terminal domain.

36. A receptor cassette encoding a chimeric receptor polypeptide comprising:

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- a) a DNA binding (C) domain;
- b) a hinge (D) domain of an insect ecdysone receptor (EcR);
- c) a ligand binding (E) domain of an ecdysone receptor of a lepidopteran insect other than *Bombyx mori*, wherein said ligand binding (E) domain is heterologous with respect to said hinge (D) domain; and
- d) an activation domain.

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37. A receptor cassette according to claim 36, wherein said hinge (D) domain is the hinge (D) domain of a lepidopteran insect ecdysone receptor.

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38. A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 1.

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39. A recombinant vector comprising a receptor expression cassette according to claim 38.

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40. A transgenic host cell comprising a receptor expression cassette according to claim 39.

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41. A transgenic host cell according to claim 40, which is a plant cell.

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42. A transgenic plant comprising a transgenic plant cell according to claim 41.

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43.

Seed from a transgenic plant according to claim 42.

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A method of controlling gene expression in a plant, comprising:

- a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to a receptor cassette according to claim 1 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory region operatively linked to a target nucleotide sequence, wherein the 5' regulatory region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;
- b) expressing said chimeric receptor polypeptide in said plant;
- c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.

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A chimeric receptor polypeptide encoded by the receptor cassette of claim 1.

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A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 2.

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A recombinant vector comprising a receptor expression cassette according to claim 46.

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A transgenic host cell comprising a receptor expression cassette according to claim 47.

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49.

A transgenic host cell according to claim 48, which is a plant cell.

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A transgenic plant comprising a transgenic plant cell according to claim 49.

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51.

Seed from a transgenic plant according to claim 50.

- 48 52. A method of controlling gene expression in a plant, comprising:
- a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to a receptor cassette according to claim 2 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory region operatively linked to a target nucleotide sequence, wherein the 5' regulatory region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;
 - b) expressing said chimeric receptor polypeptide in said plant;
 - c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.
- 49 53. A chimeric receptor polypeptide encoded by the receptor cassette of claim 2.
- 50 54. A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 15.
- 51 55. A recombinant vector comprising a receptor expression cassette according to claim 54.
- 52 56. A transgenic host cell comprising a receptor expression cassette according to claim 55.
- 53 57. A transgenic host cell according to claim 56, which is a plant cell.
- 54 58. A transgenic plant comprising a transgenic plant cell according to claim 57.
- 55 59. Seed from a transgenic plant according to claim 58.
- 56 60. A method of controlling gene expression in a plant, comprising:

- a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to a receptor cassette according to claim 15 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory region operatively linked to a target nucleotide sequence, wherein the 5' regulatory region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;
- b) expressing said chimeric receptor polypeptide in said plant;
- c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.

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-61.

A chimeric receptor polypeptide encoded by the receptor cassette of claim 15.

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A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 16.

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A recombinant vector comprising a receptor expression cassette according to claim 62.

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64.

A transgenic host cell comprising a receptor expression cassette according to claim 63.

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65.

A transgenic host cell according to claim 64, which is a plant cell.

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A transgenic plant comprising a transgenic plant cell according to claim 65.

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67.

Seed from a transgenic plant according to claim 66.

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A method of controlling gene expression in a plant, comprising:

- a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to

a receptor cassette according to claim 16 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory region operatively linked to a target nucleotide sequence, wherein the 5' regulatory region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;

b) expressing said chimeric receptor polypeptide in said plant;

c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.

69. A chimeric receptor polypeptide encoded by the receptor cassette of claim 16.

70. A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 18.

~~71.~~⁶⁷ A recombinant vector comprising a receptor expression cassette according to claim 70.

72. A transgenic host cell comprising a receptor expression cassette according to claim 71.

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73. A transgenic host cell according to claim 72, which is a plant cell.

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74. A transgenic plant comprising a transgenic plant cell according to claim 73.

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75. Seed from a transgenic plant according to claim 74.

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76. A method of controlling gene expression in a plant, comprising:

a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to a receptor cassette according to claim 18 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory

region operatively linked to a target nucleotide sequence, wherein the 5' regulatory region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;

- b) expressing said chimeric receptor polypeptide in said plant;
- c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.

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77. A chimeric receptor polypeptide encoded by the receptor cassette of claim 18.

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78. A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 20.

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79. A recombinant vector comprising a receptor expression cassette according to claim 78.

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80. A transgenic host cell comprising a receptor expression cassette according to claim 79.

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81. A transgenic host cell according to claim 80, which is a plant cell.

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82. A transgenic plant comprising a transgenic plant cell according to claim 81.

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83. Seed from a transgenic plant according to claim 82.

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84. A method of controlling gene expression in a plant, comprising:

- a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to a receptor cassette according to claim 20 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory region operatively linked to a target nucleotide sequence, wherein the 5' regulatory

region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;

- b) expressing said chimeric receptor polypeptide in said plant;
- c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.

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85. A chimeric receptor polypeptide encoded by the receptor cassette of claim 20.

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86. A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 30.

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87. A recombinant vector comprising a receptor expression cassette according to claim 86.

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88. A transgenic host cell comprising a receptor expression cassette according to claim 87.

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89. A transgenic host cell according to claim 88, which is a plant cell.

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90. A transgenic plant comprising a transgenic plant cell according to claim 89.

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91. Seed from a transgenic plant according to claim 90.

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92. A method of controlling gene expression in a plant, comprising:
a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to a receptor cassette according to claim 30 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory region operatively linked to a target nucleotide sequence, wherein the 5' regulatory region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;

- b) expressing said chimeric receptor polypeptide in said plant;
- c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.

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A chimeric receptor polypeptide encoded by the receptor cassette of claim 30.

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A receptor expression cassette comprising a heterologous promoter sequence operatively linked to a receptor cassette according to claim 36.

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A recombinant vector comprising a receptor expression cassette according to claim 94.

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96.

A transgenic host cell comprising a receptor expression cassette according to claim 95.

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97.

A transgenic host cell according to claim 96, which is a plant cell.

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98.

A transgenic plant comprising a transgenic plant cell according to claim 97.

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99.

Seed from a transgenic plant according to claim 98.

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100.

A method of controlling gene expression in a plant, comprising:

- a) transforming said plant with a receptor expression cassette comprising a 5' regulatory region capable of promoting expression in a plant cell operatively linked to a receptor cassette according to claim 36 encoding a chimeric receptor polypeptide, and a 3' terminating region; and a target expression cassette comprising a 5' regulatory region operatively linked to a target nucleotide sequence, wherein the 5' regulatory region comprises one or more response elements complementary to the DNA binding (C) domain of said chimeric receptor polypeptide;
- b) expressing said chimeric receptor polypeptide in said plant;

c) contacting said plant with a chemical ligand that is complementary to the ligand binding (E) domain of said chimeric receptor polypeptide, whereby said chimeric receptor polypeptide in the presence of said chemical ligand activates expression of said target nucleotide sequence.

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101. A chimeric receptor polypeptide encoded by the receptor cassette of claim 36.